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**Critical Literature Review
(ANTA602)**

**Antarctic Specially Protected Areas as tools for
conservation: An assessment of purpose, placement
and effect**

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Abstract

Offering the highest level of protection under the current Antarctic Treaty System, Antarctic Specially Protected Areas are often considered a key tool in the conservation of terrestrial Antarctica (Shaw et al 2014). However as conservation science evolves, and approaches to conservation planning become more systematic, the capability of these areas to meet long-term Antarctic conservation objectives has been questioned. To address this, both the placement and management of existing Antarctic Specially Protected Areas is reviewed, in order to assess whether, as a system, Antarctic Specially Protected Areas 1) designate adequate area, representative Antarctic biodiversity, and 2) effectively separate it from threatening processes. Finding that in the short term, stricter compliance with management guidelines and monitoring is required by Treaty Parties, and in the long term, that meeting representativeness and comprehensiveness requirements is impeded by both a gap in available data and the placement of existing system, it is clear that both the management and designation processes of ASPA's requires review if Antarctic conservation objectives are to be achieved.

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Introduction

With the expansion of both science and tourism over the last 20 years, human presence in the Antarctic has increased significantly (Hughes & Convey, 2010). Over 40,000 personnel now visit the region annually, and with this number predicted to rise, effective techniques to ensure the protection and maintenance of Antarctica's unique ecosystems are becoming more important than ever (Frenot et al., 2005; COMNAP 2009; Hughes & Convey, 2010).

As the cornerstones of conservation, the implementation of well managed, well placed protected areas is now widely considered an effective measure to ensure the long term protection of biodiversity (Rodrigues et al., 2004). Worldwide, over 18.4 million km² (12.5%) of the terrestrial domain and 10.1 million km² (3%) of the marine domain is officially protected, and sufficient evidence now exists to suggest that through effective designation and management habitat loss (the primary threat to biodiversity worldwide), and population decline rates for threatened species can be reduced (Watson et al., 2014).

However, as conservation science continues to evolve, and approaches to conservation planning become more systematic, inadequacies and deficiencies in existing protected area networks are becoming apparent (Shaw et al., 2014; Watson et al., 2014). The Antarctic continent has not escaped scrutiny, and recently the role of Antarctic Specially Protected Areas (ASPAs) in achieving both Antarctic conservation objectives and global conservation targets has been questioned (Shaw et al. 2014; Hughes et al 2013). With significant inadequacies identified in both placement and management, it is timely that the existing ASPA system be reviewed in accordance with the underlying principles of effective conservation planning, and, that its efficacy in 1) designating areas that adequately represent Antarctic biodiversity, and 2) separating these from threatening processes, be assessed.

1. Purpose of Antarctic Specially Protected Areas

Under Annex V to The Protocol for Environmental Protection to the Antarctic Treaty (1991) (The Environment Protocol), ASPAs offer the highest level of area protection within the Antarctic Treaty area (Pertierra & Hughes, 2013). Designated on the basis of having *“outstanding environmental, scientific, historic, aesthetic or wilderness values, any combination of those values, or ongoing or planned scientific research”* in order to *“prohibit, manage, or restrict”* activities within their boundaries, the broader purpose of the ASPA system is to ensure *“the comprehensive protection of the Antarctic environment and dependent and associated ecosystem”* in accordance with Article 2 of The Environment Protocol (Annex V, Article 3(1); Annex V, Article 2) .

1.1 Framework for the designation Antarctic Specially Protected Areas

The designation of ASPAs is outlined in Article 3(2) of Annex V, and requires the identification of potential ASPAs *“within a systematic environmental-geographical*

framework.” Broken into 9 categories, Article 2(a)-(i) of Annex V specifies that the system should represent:

- (a) areas kept inviolate from human interference so that future comparisons may be possible with localities that have been affected by human activities;*
- (b) representative examples of major terrestrial, including glacial and aquatic, ecosystems and marine ecosystems;*
- (c) areas with important or unusual assemblages of species, including major colonies of breeding native birds or mammals;*
- (d) the type locality or only known habitat of any species;*
- (e) areas of particular interest to ongoing or planned scientific research;*
- (f) examples of outstanding geological, glaciological or geomorphological features;*
- (g) areas of outstanding aesthetic and wilderness value;*
- (h) sites or monuments of recognised historic value; and*
- (i) such other areas as may be appropriate to protect the values set out in paragraph 1 above.*

Under Article 3(1) of the Protocol, these areas can be proposed by any ‘Party, the Committee, the Scientific Committee for Antarctic Research or the Commission for the Conservation of Antarctic Marine Living Resources’, through the submission of ‘a proposed Management Plan to the Antarctic Treaty Consultative Meeting’ (Annex V, Article 5(1)). This plan includes (as appropriate) the purpose, objective, value, description and location/boundaries for the protected area, along with any allowable activities within it, and the conditions for access (Annex V, Article 5(3)(a) – (i)). Upon receipt, the Committee will consider any comments and approve in accordance with the agreement procedures outlined in the Antarctic Treaty (Annex V, Article 6(1)).

Unless stated otherwise in the approved plan, the designation of an ASPA will be indefinite, with a review of the area initiated every 5 years and review of the corresponding Management Plan initiated as required (Article 6(3)-(5)).

1.2 Purpose of existing the existing Antarctic Specially Protected Area System

Currently, 75 ASPA’s have been designated on the basis of having significant value, corresponding to the 9 categories outlined in Annex V, Article 3(2) (Antarctic Treaty Secretariat, 2014.)(Table 1). The majority of these ASPA’s are recognised for their biodiversity or environmental value, with only 6 currently in place for historical values, 9 for interest to scientific research, and zero for type locality or only known species (Antarctic Treaty Secretariat, 2014.; Hughes et al 2013). However the ability of those ASPAs designated for biodiversity or environmental value to truly meet The Environment Protocol’s objective is uncertain (Hughes et al 2013).

In recent years, the ASPA designation process has been described as ‘lacking clear strategy’, and not for the purpose of ‘securing terrestrial biodiversity’ (Terauds et al. 2012, p. 736; Hughes et al. 2013, p. 120). On the basis of this, there has been a clear call for the development of an environmental-geographical classification framework to enable the identification of sites that are capable of meeting the objectives of The Environment Protocol and Annex V (Shaw et al., 2014; Hughes & Convey, 2010).

Primary reason for designation	No. areas	Area(km ²)
Areas kept inviolate from human interference so that future comparisons may be possible with localities that have been affected by human activities;	2	5.54
Representative examples of major terrestrial, including glacial and aquatic, ecosystems and marine ecosystems;	10	33.06
Areas with important or unusual assemblages of species, including major colonies of breeding native birds or mammals;	39	1747.29
Areas of particular interest to ongoing or planned scientific research;	9	970.75
Examples of outstanding geological, glaciological or geomorphological features;	6	671.62
Areas of outstanding aesthetic and wilderness value;	1	418.14
Sites or monuments of recognised historic value;	6	0.3
Outstanding environmental, scientific, historic, aesthetic or wilderness values, any combination of those values or on-going planned scientific research; and	2	15.14
The type locality or only known habitat of any species	0	0
Total	75	3861.84

Table 1. Primary reason for ASPA designation and ASPA area (Antarctic Treaty Secretariat, 2014).

2. A “systematic environmental-geographical framework”

The development of the Environmental Domains model and the Antarctic Conservation Biogeographic Regions (ACBR) has been a significant step toward realising a framework aligned with the requirements of Article 3(2) (Morgan et al., 2007; Terauds et al., 2012).

The Environmental Domains Analysis (EDA), adopted at the 31st Antarctic Treaty Consultative Meeting, classifies the Antarctic continent into 21 distinct environments based on abiotic variables (Morgan et al., 2007; Terauds et al., 2012). As a model capable of identifying potential ASPA's within a systematic framework, the use of the EDA was recommended as a tool to fulfil the ‘systematic geographical framework’ referred to in Annex V to The Environment Protocol (Terauds et al., 2012).

Recognising an absence of biological information, Terauds et al (2012) then further developed the EDA to include biodiversity distribution data. This model incorporated records of terrestrial plants, microbes and invertebrates located on ice-free areas of the Antarctic continent, Antarctic Peninsula and islands, and lead to the identification of 15 discrete ACBR's (Terauds et al., 2012). Described as the equivalent of the global ecoregions, the ABCR's represent a minimum set of areas requiring representation if the continent's biodiversity is to be adequately protected (Shaw et al., 2014; Terauds et al., 2012).

As a framework with the capability to identify ASPA's that comprehensively represent terrestrial Antarctica, the ACBR's will potentially play a key role in ensuring future ASPA's meet the objectives of Annex V and The Environment Protocol.

3. Comprehensive, representative examples of Antarctic ecosystems

As the underlying principles of modern systematic conservation planning, and key objectives within The Environment Protocol, the adequate designation of both representative and comprehensive ASPA's is required if the ASPA system is to fulfil its purpose (Margules & Pressey, 2000; Possingham et al. 2006). However, few studies have

addressed this in an Antarctic context. This is significant, as both representativeness and comprehensiveness are specified as the purpose of the Protocol and Annex V. However it should also be recognised that these principles are not the sole determinants of protected area success. In systematic conservation planning, additional features such as area, size, connectivity and shape have also been found to significantly influence protected area system efficacy (Margules & Pressey, 2000).

3.1 Adequacy in the existing Antarctic Specially Protected Area system

Currently, only one study, Shaw et al (2014), has directly assessed the objectives of representativeness and comprehensiveness and under the existing system. Finding that on the basis of the current ASPA distribution, existing ASPA system was 'inadequate, unrepresentative, and at risk', Shaw et al. (2014) showed that only 1.5% of the continents ice-free areas and 1.1% of the ACBR's were protected under ASPA's system, that 5 ACBR's were not represented at all, and of those that were, none had greater than 10% of their area protected (Shaw et al., 2014, p.6). The study also found that two of the ACBR's contained most of the 55 ASPA's identified as being designated for biodiversity conservation, and when compared to other continents, Antarctica's ASPA system was in the lowest quartile for percentage of area protected overall (Shaw et al., 2014).

In order to address these inadequacies, Shaw et al. (2014) called for the designation of ASPAs through a more systematic approach, that is capable of ensuring global conservation targets are achieved.

3.2 Spatial distribution of Antarctic Specially Protected Areas

In the current protected area system under Annex V, approximately 69997.5km² of area is designated within the Antarctic Treaty Area (Secretariat of the Antarctic Treaty, 2014). Of this, 3861.84km² is designated as Antarctic Specially Protected Area (Secretariat of the Antarctic Treaty, 2014).

The majority of ASPA located on the periphery of the continent, clustered, and close to research stations or areas of substantial human activity. In Hughes et al. (2013) it was found that more than 56% of ASPAs designated for both science and conservation existed within 25km of a research station (28% being within 3km), leaving other more remote areas of the continent unprotected. It was also found, that as areas easier to access, those within 3km of research station were visited almost twice as often and those further away. In more remote ASPA's other studies have found visitation to be significantly lower, some having zero visits over the course of several years (Perterra & Hughes, 2013).

Although this distribution is reflective of higher threats and therefore need for area protection close to human activity, situating APSA's close to human activity can significantly impact conservation outcomes (Hughes et al., 2013). Recent studies have found that ASPAs close to human activity are often more vulnerable to more direct threats (such as trampling) and non-indigenous species introductions (Shaw et al 2014, Hughes et al., 2013; Tejedó et al., 2012). Tejedó et al. (2012), showed the threshold at which damage to soil fauna from trampling could be as low as 100-300 foot passes. Tejedó et al. (2009) also highlighted the limited resilience of Antarctic soils to trampling.

For susceptibility to non-indigenous species invasions, Shaw et al. (2014) showed that of the 55 ASPA's designated in ice free areas for their biodiversity value, 7 (all on the Antarctic Peninsula) were at high risk, and overlapped with previously identified high risk areas (Shaw et al 2014; Chown et al 2012). In addition, the mean risk index of non-indigenous species establishment in ASPA's was significantly higher compared to randomly selected ice free regions.

Spatial factors aside from proximity to human activity that also impact conservation outcomes, such as connectivity and low surface area to boundary length ratio do not appear to have been directly addressed. However in Hughes et al. (2010), most (62.5%) of ASPAs were found to exist immediately beside ice-free areas, and 90% within 1km of ice free area suggesting some connectivity to areas with developed ecosystem and perhaps a greater capability of APSA's to maintain broader scale biological processes (dispersion, migration, ecosystem functioning). However Hughes et al. (2013), identified that 55% of ASPAs designated on the basis of science and/or conservation were less than 5km² in area. Shaw et al. (2014) also identified that of Antarctica's ice free area (46.253km²), where most developed terrestrial ecosystems exist, only 1.5% was designated as protected. This suggests that, the small area of individual ASPA's may not be sufficient to ensure protection in long term, particularly if species ranges shift in response to changing climate.

4. Protection of the Antarctic environment and associated ecosystems

As the means of separating the values within protected areas from threatening processes, protected area management also plays a key role in ensuring conservation objectives are met (Margules & Pressey, 2000). For existing ASPA's, management requirements and guidelines, including permitting, monitoring and information transfer for existing ASPAs are outlined from Article 6, Annex V to The Environment Protocol.

4.1 Framework for management of Antarctic Specially Protected Areas

Under Article 7(1), the issuing of entry permits to all ASPAs is required and, it is the responsibility of the party initiating the designation the ASPA to issue the permit in accordance with the ASPAs specific Management Plan requirements (Annex V, Article 7(1)). It is also the responsibility of the initiating Party to collect and exchange records of any permits issued (Article 10), visits and inspections, any damage or significant changes, and report these to the Committee and other Parties on an annual basis (Annex V, Article 10(1)-(2)).

Despite this framework, a recent assessment of permitting, information transfer and visitation found that in many cases, visitation data and information transfer requirements were not always fulfilled (Perterra et al., 2013). Over the three year period assessed, it was found that many parties failed to provide complete permit/visitation data, and some (two) provided none at all (Perterra et al., 2013). In addition, visitation data was not sufficient to identify cumulative impacts within ASPAs (Perterra et al. 2013). From the data that was available, 32% of visitations were found to be in ASPAs designated for the purpose of terrestrial conservation, with visitation

rates significantly higher in those ASPAs located on the Antarctic Peninsula and Ross Sea region, compared to those in east Antarctica (Perterra et al., 2013).

This indicates that although comprehensive, current management guidelines may not necessarily achieve their purpose of protecting those values ASPA's contain.

4.2 Purpose and management of existing Antarctic Specially Protected Areas

As ASPA's need not be designated solely for the purpose of protecting biodiversity, a number have been designated to fulfil multiple roles (Hughes et al., 2013). For those designated for science and conservation after The Environment Protocol came into force (1998) in particular, priority purpose is often unclear (Hughes et al., 2013). This has been described as problematic, as management requirements for each can be conflicting, with those beneficial for science compromising conservation outcomes and vice versa (Hughes et al., 2013). In Hughes et al. (2013) this effect was demonstrated, with visitation data over a 3 year period showing that those ASPAs protecting both scientific research interests and Antarctic habitat or biological communities were visited three times as often as those protecting only habitat or biological communities alone. This suggests that in some ASPA's, or where purpose is not clearly defined, scientific interest or other purpose may come at the expense of conservation outcomes (Hughes et al., 2013).

Conclusion

In Antarctic terrestrial systems, the most significant threats to Antarctic biodiversity are climate change and invasive species (Terauds et al., 2012). Second to these are more direct factors arising from human presence, such as trampling and contamination (Tin et al 2009). On the basis of the above assessment, in the short term, management guidelines have been partially effective in prevent direct human impacts through restricting access (Hughes et al., 2013; Perterra & Hughes, 2013). However stricter compliance with information transfer techniques and reporting requirements is necessary if the effectiveness of these measures is to be realised, and accurately assessed.

However in the long term, it is clear that effective management alone is unlikely to ensure the adequate maintenance of biodiversity on a continent-wide scale (Terauds et al., 2012). In a rapidly changing world, under increasing pressure from climate change and resource extraction, the establishment of not only representative, but resilient networks is required (Convey, 2011). To fully achieve the conservation objectives of Annex V and The Environment Protocol, it is clear a more systematic approach is required (Shaw et al., 2014). With the development of the ACBR's, a significant step has been taken towards realising the requirements for representativeness and comprehensiveness, however, this is not yet reflected in the current ASPA system (Shaw et al. 2014). Achieving these objectives fully also remains restricted by substantial gaps in species, ecosystem and distribution data for the Antarctic continent (Terauds et al., 2012). Secondary factors such as shape, size and connectivity that enhance performance

and resilience on a broader scale too, require consideration during the designation process if the ASPA system is to operate effectively in the long term.

As global support for protected areas declines in the wake of resource demand and reduced funding, efficient and high performing protected area systems are becoming more important than ever (Watson et al., 2014; Osti et al. 2011). On the basis of this, it is clear that both the ASPA placement and ASPA management process requires review before the addition of new ASPA's, or replacement of existing ASPA's occurs, if Antarctic conservation objectives are to be achieved.

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